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MOUNTAIN PINE BEETLE AND BLACK HILLS BEETLE CONDITIONS
IN THE PINE STANDS OF FOREST SERVICE REGION 4

OCTOBER 1959

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MOUNTAIN PINE BEETLE AND BLACK HILLS BEETLE CONDITIONS
IN THE PINE STANDS OF FOREST SERVICE REGION 4

By

R. I. Washburn and Walter E. Cole
Entomologists

INTRODUCTION

This report presents current information on infestations of mountain pine beetle, Dendroctonus monticolae Hopk., and Black Hills beetle, Dendroctonus ponderosae Hopk. in lodgepole pine and ponderosa pine stands of U. S. Forest Service Region 4. The mountain pine beetle attacks both lodgepole and ponderosa pine. Most epidemics occur in mature lodgepole pine or in second-growth ponderosa pine. The occurrence of Black Hills beetles in Region 4 is limited to southern Utah and the Charleston Mountain area of Nevada. It usually builds to epidemic proportions in mature and overmature timber. However, during epidemics it attacks trees as small as 5 inches DBH.

Lodgepole pine occurs throughout the northern half of the region which includes northern Utah, western Wyoming, and southern Idaho. Ponderosa pine, on the other hand, occurs in six widely separated areas. The area around Boise, Idaho and north into Region 1 includes the Boise and Payette National Forests. A small area exists south and east of Manila, Utah, surrounded by vast bodies of lodgepole pine and a limited amount occurs in the vicinity of Roosevelt, Utah. In southern Utah there is an extensive area of ponderosa pine with Panguitch, Utah being about the center of the type. The LaSal Division of the Manti-LaSal National Forest near Moab, Utah also contains stands of ponderosa pine. A small area of ponderosa pine is found on Charleston Mountain out of Las Vegas, Nevada. In western Nevada another area of ponderosa pine occurs in the Mono Division (west side) of the Toiyabe National Forest in Region 4, near Reno. Here the ponderosa pine represents the eastern edge of the east side ponderosa stands of California.

Large-scale outbreaks of mountain pine beetle causing extensive damage have been rather common in lodgepole pine forests of Region 4. In the past, only a few of these outbreaks were treated, due primarily to the low commercial value of lodgepole and the difficulties encountered in doing direct control work. The Targhee-Teton mountain pine beetle project running through from 1946 to 1950 was the first large outbreak where all-out control was attempted. Here, for the most part, toxic chemicals were used to combat the beetle.

In the last few years the value of lodgepole pine as a commercial species has increased significantly. Consequently, more and more effort has been devoted to detecting and suppressing mountain pine beetle outbreaks in lodgepole pine.

Ponderosa pine, on the other hand, has long been regarded as a valuable commercial species. Therefore, nearly all the past outbreaks of Black Hills beetle have been attacked vigorously. Only recently has mountain pine beetle become active in second-growth ponderosa stands. There are many examples where outbreaks of Black Hills beetle in pine have been curbed in their early stages by removal of infested trees through the adjustment of the logging program; others have required direct control but have received prompt attention. Nevertheless, the importance of recognizing and controlling menacing outbreaks has been emphasized to a greater extent in the last few years. With the increased emphasis on detection and suppression it becomes important to keep all forest workers informed on the current conditions throughout the region. It is equally important, in a region where resources are primarily mature and overmature stands, to recognize that not all spots of bark beetle activity may require control action. For this reason the Division of Forest Insect Research inspects most areas of bark beetle activity to determine the seriousness of the situation by an evaluation of the biological and physical factors present that may influence the trend of the infestation.

The intent of this report is to consolidate the information available on all known bark beetle epidemic centers in lodgepole pine and ponderosa pine in Region 4, and to present the entomologists' evaluation of the significance of each.

Throughout the report tables show the data collected on the three basic population density measurements and in some cases estimates of the size of areas and numbers of infested trees.

TARGHEE NATIONAL FOREST

Aerial detection surveys in 1958 located several areas on the Targhee National Forest suspected of containing new centers of infestation. Subsequent ground inspections confirmed the fact that mountain pine beetle populations were present in epidemic numbers. During the summer of 1959 the Targhee directed a chemical treating program against these epidemic centers. Additional chemical treatment will be necessary next summer to further reduce the beetle population in these areas.

Fall aerial detection surveys revealed several new areas suspected of containing mountain pine beetle activity. Ground examination of the Davis Lake Wells areas and the Big Bend Ridge area proved that the mountain pine beetle was not epidemic. Evaluation of the brood showed a decided decrease in potential. Two areas on District 5, west of Driggs, Idaho, in Dry Fork Creek and in Mahogany Draw were examined on the ground

and here it was determined that the mountain pine beetle showed a definite increasing tendency. In Dry Fork Creek there are an estimated 200 infested trees on approximately 50 acres. In Mahogany Draw approximately 250 on 70 acres. The biological evaluation recorded 448.2 brood and 11.6 gallery starts per square foot of sample taken at breast height. Parasites and predators were in insufficient numbers to cause unusual brood mortality. These two areas show characteristics of an explosive type buildup in lodgepole pine stands.

The Dry Creek logging area has been under surveillance for the last 2 years. It is located due north of the infestation on State and private land around Sheridan Reservoir. We estimate there are about 150 infested trees on approximately 100 acres. This infestation now shows definite increasing tendencies with the brood sample showing 351 brood which originated from 5.4 starts of gallery in 110 inches of gallery per square foot of sample. Woodpecker activity is moderate to heavy but it is concluded woodpeckers alone will not curb the increasing tendency of this spot infestation. There is, of course, the possibility that the woodpeckers may vacate this area in favor of the more heavily infested area around Sheridan Reservoir.

KILGORE, IDAHO

Three small spot infestations of mountain pine beetle have been present in the vicinity of Kilgore, Idaho for several years. Examinations through 1956 revealed that these hot spots were neither showing increasing tendencies nor enlarging rapidly. Fall examinations in 1957 revealed a brood potential that indicated a possible increase for 1958. In 1958 suspicions that the infestation had reached epidemic status were confirmed. Sampling of brood showed larval populations averaging 191 per square foot of sample at breast height. Although brood density was slightly less than found on other adjoining infestations it was concluded sufficient to indicate a decided increase in numbers of trees that might be attacked in 1959. Biological evaluations for 1959 confirmed this conclusion by showing approximately 2 new trees attacked for every red topped tree in the area. In addition, it revealed that brood density had more than doubled in one year, the 1959 figures showing an average of 444.6 brood and 11 starts of galleries per square foot. Evidence showed that approximately 40 percent of the infested stem on the majority of the trees infested last year was woodpeckered. Nevertheless, it was concluded that natural factors, including woodpecker populations, probably would not reduce beetle brood to an extent that a marked reduction in the number of trees attacked next year would occur. It is estimated that there are now about 3,000 infested trees on 3,600 acres of these three units.

GRAND TETON NATIONAL PARK

Since 1955 a steady increase in mountain pine beetle activity has been observed each year on Grand Teton National Park. A chemical treatment program was started in 1957 to minimize the loss of lodgepole pine caused by this destructive beetle. Treating was carried on in 1958 and again in 1959 when the Park Service treated 5,110 infested trees on 3,100 acres, covering 3 units, East Signal Mountain, Signal Mountain, and Pacific Creek.^{1/}

Evaluations of the infestation centers this fall show that although the number of infested trees has decreased (due to effective treatment) the epidemic tendency of the mountain pine beetle remains in all but the East Signal Mountain unit. Here the infestation appears to be static, that is, we expect if the pattern continues only about 1 tree will be attacked next year for every tree now infested.

Table A

Unit	Area in acres	Number infested trees	Brood density per sq.ft.*	Gallery starts per sq.ft.	Inches gallery per sq.ft.
Signal Mt.	2,000	1,500	220.5	9.6	94.6
Ea. Sig. Mt.	700	560	121.5	5.2	59.0
Pacific Cr.	800	240	246.6	10.8	107.8
Two Ocean Lk.	1,000	200	298.8	12.0	154.0
Donoho Point	300	100	no data		
Totals	4,800	2,600			
Ave for Park			207.9	8.9	96.9

*83 percent of brood was half-grown larvae at time of evaluation, 9/16 thru 9/24.

On the basis of brood and attack density, it appears that the Two Ocean Lake unit has the most potential for rapid buildup. However, we expect that other biological factors will exert an adverse effect on the beetle population to the extent that the buildup ratio may not be much greater than 1 to 1 next year. These factors are: the woodpecker population has built up in the area to a point where the majority of the 1958 attacked trees were heavily woodpeckered for an average of three-fourths of the infested stem, and there is a decided lack of suitable host trees in the immediate vicinity of the trees presently infested.

^{1/} Dickenson, R. E. and Wilcox, G. Mountain pine beetle control project - 1959, Grand Teton National Park 4 pp. (Processed) 1959.

Pacific Creek also shows evidence of heavy woodpecker population which should reduce population density of the mountain pine beetle. There is a decided lack of visible insect predators and parasites in all units.

Considering all factors, we feel that there is sufficient entomological justification to warrant continuation of the treating program in all units. Woodpecker activity and the treating program reduce the beetle populations but remaining populations examined showed continued tendencies toward rapid buildup.

TETON NATIONAL FOREST

As a result of the aerial detection survey, several new areas of mountain pine beetle activity were discovered on the Teton National Forest, all of which were evaluated on the ground.

Table B

Unit	Size in acres	Est. No. infested trees	Brood density per.sq.ft.*	Gallery starts per sq.ft.	Inches of gallery per.sq.ft.
Ax Ranch	700	600	387.0	8.6	115.0
Spread Cr.	200	50	319.5	10.0	111.0
Blackrock Cr.	500	250	304.2	9.0	93.0
Sledrunner Cr.	1,000	600	253.8	7.0	99.8
Jack Cr.	200	100	265.5	10.0	117.6
Granite Cr.	800	250	no data		
N.F.Fisherman Cr.	300	200	443.7	9.0	126.0
Totals	3,700	2,050			
Ave. for Forest			318.6	8.6	107.2

*92 percent brood were larvae at time of examination - 9/23 thru 9/30.

All the areas except Jack Creek show a decided increasing tendency. Brood density is high and nearly all trees are filled in on all sides, with the average height of attack exceeding 20 feet. The attacked trees appear in tight groups surrounded by an abundance of suitable host material. Woodpecker activity is light and there is a definite lack of visible insect predators and parasites. We feel that the buildup ratio in these areas could go as high as 2 to 1 next year unless unexpected brood mortality occurs.

The Jack Creek infestation contains heavy brood but is not expected to increase rapidly, mainly because there is a scarcity of lodgepole pine in the diameter classes above 10 inches DBH, and the majority of the trees now infested average less than 10 inches DBH. Experience has shown that for the most part brood production in smaller trees is subject to

higher winter mortality than brood produced in larger trees. We expect only about 1 to 1 buildup ratio in this area next year. There is, of course, the possibility that sufficient brood may survive to give rise to a slight increase in the number of small trees attacked next year. Unfortunately, woodpecker activity is very light.

There seems to be sufficient entomological justification for a continuation of the treating program in most of the areas that were treated this year.

WASATCH NATIONAL FOREST

The control program directed against the large-scale mountain pine beetle infestation on the north side of the Wasatch National Forest was started in 1958. Treating has been carried out, both in the spring and in the fall. In an effort to prevent spread into new areas 50,872 trees were treated in 1958. The 1959 treating program is still in progress. Consequently, the number of trees treated is not available. The Wasatch's operational survey showed the infestation now contains an estimated 110,360 infested trees on 116,344 acres. Aerial and ground surveys of the perimeter of the infestation shows the east and west boundaries of the infestation have been pushed in slightly. Unfortunately, a tendency to spread southward is evident in several areas. The spread is most noticeable in the vicinity of Gilbert Meadows and Smith Fork Creek.

A separate biological evaluation for each of the major subdivisions within the infestation was made in August. The results show the mountain pine beetle still retains its initiative to increase in all but one area. In the middle fork of the Beaver Creek, egg deposition, number of starts of galleries, and inches of galleries constructed, was considerably less than the average for other areas in the infestation (Table C).

Table C

Unit	Brood density per.sq.ft.	Gallery starts per sq.ft.	Inches gallery per.sq.ft.	
Bridger Lake	254.7	11.4	68.2	increasing
Middle Fk. Beaver	103.3	7.4	47.8	decreasing
Poison Mtn.	287.1	9.8	91.0	increasing
Smiths Fk-Dahlgren	224.1	11.2	64.8	increasing
Dead horse	279.0	5.4	67.6	increasing
China Lake Meadows	168.3	9.8	66.8	
Ave. for infestation	219.6	9.2	66.8	

Around China Lake Meadows the average number of eggs per square foot of sample was under 200, but it was evident egg deposition was not complete. Nevertheless, sufficient evidence was available to indicate the beetle population had definite increasing tendencies. To explain why an infestation subject to two years of intensive control action now contains the same number of infested trees as it did at the start of the project requires an analysis of the following factors: (1) It has been physically impossible to cover all of the infested area with two years of treatment. This provides opportunity for a rapid increase in number of infested trees in untreated areas. (2) The brood potential throughout most of the infestation is such that each infested tree is producing enough brood to successfully attack 2 to 4 new trees each year.

The treatment has been successful to the extent that the infestation boundaries have been pushed in on the east and west sides. In addition, it is evident that with high brood potential many more trees would now be infested if control work had not destroyed the beetle population in the trees treated.

A new infestation was located this fall during an aerial detection survey in the Beaver Creek sale area on the north slopes of Iron Mine Mountain. Biological evaluation of this infestation shows there are about 700 infested trees on 3,000 acres. The beetle population has been active in the area for several years but undetermined factors have held the broods in check until last year. The evaluation indicates the picture changed to where abundant broods emerged and attacked trees the summer of 1958. These trees also produced a heavy brood population that attacked about one and a half times as many trees in 1959. Trees examined on the 9th of October had a brood density of 360 and an attack density of 15.4 per sq. ft. at breast height. There was a decided lack of visible parasites and predators. The trees, for the most part, are overmature and of large diameter. The average DBH of the infested trees is over 24 inches. The District Ranger's office indicated that an effort will be made to sell this stand of lodgepole pine. If this timber is cut within the next year a chemical treating program would not be necessary except to treat unmerchantable trees.

ASHLEY NATIONAL FOREST

The Ashley National Forest has been controlling a mountain pine beetle outbreak in the Pole Creek area since 1957. The program includes the removal of merchantable infested material by logging and chemical treatment of the smaller or inaccessible infested trees. Operational surveys conducted by Administration show there are approximately 1,000 infested trees remaining in the area.

Two infestations have been under surveillance for several years. These are in Hells Canyon, west of Yellowstone Guard Station and in the Wilderness Area in Lake Fork Creek. Both of these areas were evaluated on the ground. The Hells Canyon infestation has shown a definite decreasing

trend for the past 2 years. Examinations this fall show the trend is still downward and the infestation is rapidly passing out of the picture. The Lake Fork infestation, located in the vicinity of the mouth of Oweep Creek, covers about 3,000 acres, with approximately 800 infested trees. This infestation has not increased in size for the last 3 years. Data collected this fall shows that there is slightly more than one newly attacked tree for every tree attacked last year. This slight increasing tendency, coupled with other biological data on brood development indicates that this infestation could develop to epidemic proportions in the next couple of years.

Table D

Unit	Size in Acres	Est. No. infested trees	Brood density per sq.ft.*	Gallery starts per sq.ft.	Inches of gallery per sq.ft.
Pole Cr.	1,000	1,000	Est. by NFA		
Hells Canyon	1,000	150	150.3	6.0	60.0
Lk. Fk. Cr.	3,000	800	235.8	6.2	103.8
Totals	5,000	1,950			
Ave. for Areas			193.5	6.2	81.9

*87 percent of brood larvae at time of examination 9/5 - 9/16.

From the entomological viewpoint, continued treatment of the Pole Creek infestation is warranted. Entomologically, control action in Hells Canyon infestation could not at this time be justified. Conversely, the nature of the Lake Fork infestation is such that if this area is to be protected from sizeable losses of lodgepole pine, it will probably be necessary to initiate control action either in 1960 or 1961.

SAWTOOTH NATIONAL FOREST

Active infestations of mountain pine beetle have been observed for the past few years within drainages of Big and Little Smokey Creeks and the south fork of the Boise River on the Sawtooth National Forest. Control action was initiated the spring of 1958 and a total of 2,781 trees sprayed. In the spring of 1959 an additional 1,160 trees were sprayed. Infestations have been reduced considerably within the Big and Little Smokey Creek drainages in the lower portion of the south fork of the Boise River. However, infestations continue within the Warm Springs and Pass Creek drainages and a new infestation appeared at the forks of Ross Fork and Johnson Creek in the upper reaches of the south fork of the Boise River. Operational surveys in the fall of 1959 estimate there are now $5,351 \pm 752$ currently infested trees on about 5,946 acres. Biological evaluation indicates that less than one percent of the lodgepole pine in these areas are currently infested; approximately 3 percent has been killed.

The following table lists the brood density, gallery starts, and inches of gallery per square foot in a few selected areas that were sampled. The diameter of the attacked trees ranged from 4 to 24 inches with an average of 14 inches. Normal parasite populations were noted and only within Red Warrior and Ross Fork ranges were woodpeckers observed at a level that would exert any controlling influence.

Table E

Unit	Brood density	Gallery starts	Gallery inches
Red Warrior Creek	30.6	9.2	61.4
Jones & Bear Creek	157.5	12.0	76.0
Emma & So. Fk. Creek	187.2	11.6	57.0
Castle Creek	81.0	10.8	48.2
So. Fk. Boise River	490.5	13.0	65.0
Ave./Forest	129.6	11.0	60.2

There are areas on the Sawtooth where continued control effort will be required to complete the program previously undertaken and prevent increases in newly discovered areas.

BOISE NATIONAL FOREST

During the fall of 1958 the aerial detection surveys reported an infestation of mountain pine beetle in second-growth ponderosa pine in and around Atlanta, Idaho. An evaluation was conducted and because of the distinct threat to the stands control was undertaken. In the spring of 1959, 1,397 trees were cut, decked, and burned on 360 acres.

A 5 and 10 percent systematic survey was conducted by the forest personnel in the fall of 1959; 1,221 acres were surveyed and it was estimated that 561 ± 366 infested trees remained for control in 1960. Approximately 0.3 percent of this timber stand is currently infested and 1.7 percent has been killed. Trees attacked ranged from 4 to 18 inches d.b.h. with the average being 8.5 inches. Infested trees occur generally in groups with very few single trees attacked.

Based on samples taken at breast height an average of 18.4 gallery starts resulted in 99.2 inches of gallery per square ft. The brood sample, revealed a brood density of 691 per sq. ft. of which 26 percent were eggs, 61.5 percent larvae, and 12 percent pupae. Sampling was done in late September. The heavy brood density, tendency for the infested trees to group, and the absence of controlling numbers of predators and parasites indicates this infestation has definite increasing tendencies. Therefore, it appears desirable to continue control action in this area to minimize loss of second-growth ponderosa pine.

CRYSTAL BAY - LAKE TAHOE, NEVADA

The Crystal Bay mountain pine beetle infestation is located at the north end of Lake Tahoe in the State of Nevada. The timber is predominantly second-growth ponderosa pine and Jeffery pine, but there is some white fir, sugar pine, lodgepole pine and incense cedar. The epidemic in ponderosa pine probably started in 1949 and has continued to increase in size to a point where more trees were attacked in 1957 than had been killed in the preceding 8 years. A cooperative private, State, and Federal control program was undertaken in the spring of 1958. Altogether, slightly more than 6,000 infested trees were burned or logged. In 1959 no control action was undertaken. A biological evaluation of this infestation was made the week of October 5 by Entomologists Washburn and Cole. Information gathered from aerial observations and a general walk through showed an apparent stratification of the infestation running from east to west. Based on grouping characteristics, size of trees, density of stand, and site differences, it was decided that the infestation should be evaluated in three parts, i. e. east end, mid-basin, and the slopes above the new highway on the west edge of the basin.

On the east third of the infestation the infested tree pattern was principally groups, 1 to 5 chains from last year's red tops, with scattered singles interspersed throughout. Brood density was less in this unit than in the other two. (See table below) Visible predators and parasites were scarce.

Table F

Unit	Est. area in acres	Est. No. infested trees	Brood density*	Gallery starts	Inches gallery
East			117.9	6.4	74.8
Mid			205.2	5.6	66.0
West			162.0	7.6	99.2
Total	4,500	8,500			
Ave./Infestation			153.0	7.4	82.8

*91 percent of brood was larvae October 5-9.

The buildup ratio was estimated as 1 to 1. The average size of the infested trees was 12.2 inches DBH. The stand is less dense than in other sections and predominantly ponderosa pine with some old-growth virgin timber present. The site is good, the soil of decomposed granite.

An evaluation of the mid-basin showed the size of the groups range from 5 to 50 trees and for the most part groups were less than 2 chains from last year's red tops. Single infested trees are rare. Nearly half of the trees sampled in the mid-basin contain both mountain pine beetle and western pine beetle. A few of the larger trees contain only western pine beetle. The infested trees in the mid-basin contained more brood and

less attacks per square foot than the other 2 units. Only a few visible parasites and predators were present. The buildup ratio was estimated at 1.25 new attacks for every red top with 4 pitchouts for every 10 newly attacked trees. In general the trees of all species are taller and faster growing here than in the rest of the infestation. The average size of the infested trees sampled was 16.8 inches DBH.

The west unit differs from the rest primarily because the majority of this unit is composed of slopes making the sides of the basin. Here the site was classified as 20 percent good, 60 percent medium, and 20 percent poor. Soil type is decomposed granite with some granitic rocks and boulders. The trees are shorter and of smaller diameter averaging only 11 inches DBH. The infested trees appear in groups containing 20 to 300 trees. Most of the groups occur less than 2 chains from last year's groups. The buildup ratio is 1.25 attacks to every red top, and there are about 3 pitchouts to every 10 successfully attacked trees. Brood density fell between the estimates for the other two units. (Table F) Parasites, mostly medetera, and predators--clerids were the most prominent-- are rather common.

Considering the infestation in its entirety, the brood density averaged 153 per square foot of sample at breast height, with 91 percent of the brood in the larval stage. The buildup ratio for the total would approach 1.25 new attacks to every red top. It is estimated there are now 8,500 infested trees on about 4,000 acres. The brood potential is such that unless unexpected brood mortality occurs this winter, at least 1.25 times as many trees will be infested next year than are presently infested, which means that over 10,500 trees will be lost next year. If the land owners and managers should determine this loss to be intolerable some form of direct control action should be undertaken next spring. In addition it appears that a reduction in the number of stems per acre would elevate competition and crowding, which probably is contributing to the persistence of the beetle epidemic. It may be possible to reduce competition through a commercial thinning cut. Information on techniques, procedures and equipment necessary for treatment of infested trees will be supplied by the Division of Forest Insect Research if control should be undertaken.

DIXIE NATIONAL FOREST--BRYCE CANYON NATIONAL PARK

Operational surveys conducted by the Dixie National Forest show a decided reduction in the number of ponderosa pine infested with the Black Hills beetle. Their estimates show there are 2,200 trees currently infested in ten units scattered throughout the forest. The National Park Service estimates they have about 200 trees currently infested. Biological evaluation of this infestation shows that the downward trend reported as starting last year is continuing in all the areas where the epidemic is several years old. The history of this epidemic shows that the trend of the infestation is influenced by the amount of annual precipitation.

Severe drouth conditions were experienced again this year. Therefore, in spite of this general decreasing tendency, we suggest that if possible the infested trees should be removed by logging or treated before beetle flight to minimize the danger of a sudden reversal of the trend of the Black Hills beetle population. Continuation of the control program on Bryce Canyon National Park on a maintenance basis, can also be justified as long as severe drouth conditions persist.

DISCUSSION AND RECOMMENDATIONS

The lodgepole pine forests in areas included in U.S. Forest Service Region 4 contain a considerable number of epidemic infestations of mountain pine beetle scattered throughout the range of the lodgepole pine. Eight of twenty-two epidemic centers were treated in 1959 and of these 6 have been treated for 2 or more years. Of 12 new centers, 6 are isolated spots some distance from the nearest known infestation, the other 6 occur relatively close to previously known infestations. In all but 3 of the epidemic centers the bark beetle shows a definite tendency to increase.

Two epidemic centers of mountain pine beetle in ponderosa pine (Atlanta, Idaho, and Crystal Bay, Nevada) are widely separated from any other mountain pine beetle outbreaks. Both infestations are in second-growth timber.

The one Black Hills beetle epidemic covered in this report is in mature and overmature timber weakened by a long and severe drought. The trend of this infestation is presently decreasing but it remains potentially dangerous since the drought conditions still exist.

There are two main objectives of this report: (1) To report the present conditions of the various infestations and (2) to forecast as clearly as possible what is expected to happen in each infestation. The first can be answered with numerical data with, in most cases, estimated numbers of trees, approximate size of infestations, and figures representing brood populations.

When forecasting trends of infestations, evaluations of present conditions must consider biological information with stand, site, and other factors. An important factor, not to be overlooked, in developing a trend forecast is the ability of observers to interpret the more intangible factors. The challenge is the interpretation of biological factors that may influence brood mortality from late fall until beetle attack the following season.

Field forms have been developed to aid in gathering biological data for evaluation. The accumulation of data should result in more accurate evaluations as time goes on. In these evaluations reliance has also been placed on biological data gathered in previous epidemics occurring under similar conditions. Using brood density at breast height recorded

in the fall as a base, we know that a density of 200 per square foot will produce sufficient emerging adults to cause a decided increase in the number of infested trees of the same relative size provided no unusual brood mortality occurs.

The following tables list the infestations, brood data, and a forecast of trends.

Table G.--Summary of population density data for mountain pine beetle infestations in lodgepole pine.

Unit	Brood density per sq.ft.	Gallery starts per sq.ft.	Inches of gallery per sq.ft.	Trend
Targhee				
Dry Fork Creek	448.2	11.6	140.8	Increasing
Dr. Cr. logging area	351.0	5.4	110.0	"
Ave./Forest	411.3	10.2	133.6	
Kilgore, Idaho				
State & Private lands	407.7	10.6	114.6	Increasing
Sheridan Reservoir	481.5	11.6	155.6	"
Ave./State & Private lands	444.6	11.0	135.0	
Grand Teton Nat'l Park				
Signal Mountain	220.5	9.6	94.6	Increasing
Ea. Signal Mountain	121.5	5.2	59.0	Decreasing
Two Ocean Lake	298.8	12.0	154.0	Increasing
Pacific Creek	246.6	10.8	107.8	"
Donoho Point		No data		
Ave./ Park	207.9	8.9	96.9	
Teton				
Ax Ranch	387.0	8.6	115.0	Increasing
Spread Creek	319.5	10.0	111.0	"
Blackrock Creek	304.2	9.0	93.0	"
Sledrunner Creek	253.8	7.0	99.0	"
Jack Creek	265.5	10.0	117.6	Decreasing
No. Fk. Fisherman Cr.	443.7	9.0	126.0	Increasing
Ave./Forest	318.6	8.6	107.2	
Wasatch				
Bridger Lake	254.7	11.4	68.2	Increasing
Mid. Fk. Beaver Cr.	103.3	7.4	47.8	Decreasing
Poison Mountain	287.1	9.8	91.0	Increasing
Smiths Fk.-Dahlgren	224.1	11.2	64.8	"
Dead Horse	279.0	5.4	67.6	"
China Lk. Meadows	168.3	9.8	66.8	"
Iron Mine Mountain	360.0	15.4	121.6	"
Ave./Forest	241.5	9.8	71.8	
Ashley				
Pole Creek		No data		
Hells Canyon	150.3	6.0	60.0	Decreasing
Lake Fork	235.8	6.2	103.8	Increasing
Ave./Forest	193.5	6.2	81.9	
Sawtooth				
Red Warrior Creek	30.6	9.2	61.4	Increasing
Jones & Bear Creek	157.5	12.0	76.0	"
Emma & So. Fk. Crs.	187.2	11.6	57.0	"
Castle Creek	81.0	10.8	48.2	"
So. Fk. Boise River	490.5	13.0	65.0	"
Ave./Forest	129.6	11.0	60.2	

Table H.--Summary of population density data for mountain pine beetle infestations in ponderosa pine.

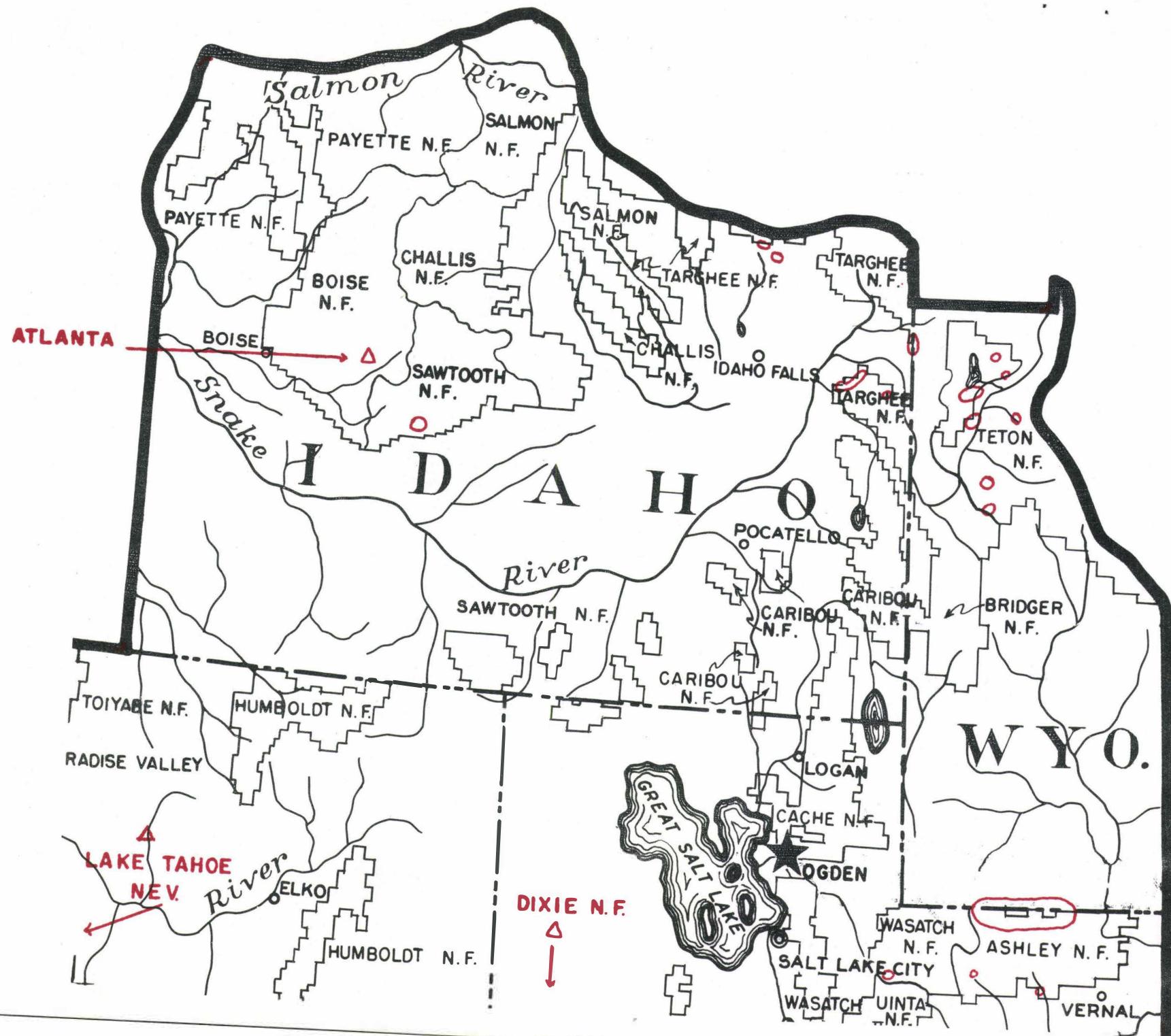
Unit	Brood density per sq.ft.	Gallery starts per sq.ft.	Inches of gallery per sq.ft.	Trend
Crystal Bay				
East	117.9	6.4	74.8	Static
Mid	205.2	5.6	66.0	Increasing
West	162.0	7.6	99.2	"
Ave./Infestation	153.0	7.4	82.8	
Boise				
Atlanta	691.0	18.4	99.2	Increasing

Several infestations with brood density of less than 200 per square foot have increasing tendencies which shows that other biological factors have overshadowed brood density in our prediction. One area, Jack Creek, on the Teton National Forest, has a brood density of over 200 but is expected to decrease. Here the small size of the infested trees, our knowledge of brood survival in small trees, and the scarcity of suitable host has governed our decision. Summarization of the seriousness of the present mountain pine beetle and Black Hills beetle situation in the pine stands of Region 4 and adjoining lands shows: (1) Each serious epidemic center represents a threat to the pine stands in the immediate vicinity of the center. (2) In the majority of the infestation centers there will probably be an increased number of trees attacked next year. Therefore, it is the opinion of the entomologists of the Intermountain Station that unless an immediate effort is made to materially reduce the beetle population in all of the serious infestation centers, heavy losses in the surrounding timber can be expected.

LODGEPOLE PINE AREAS, FOREST SERVICE REGION 4

- Mountain pine beetle infestations in lodgepole pine
- △ Mountain pine beetle infestations in ponderosa pine

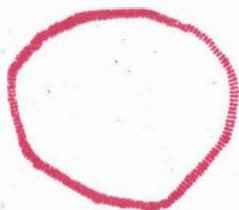
Note: Lake Tahoe and Dixie National Forest infestations
not shown on map.



LEGEND



DRAINAGES



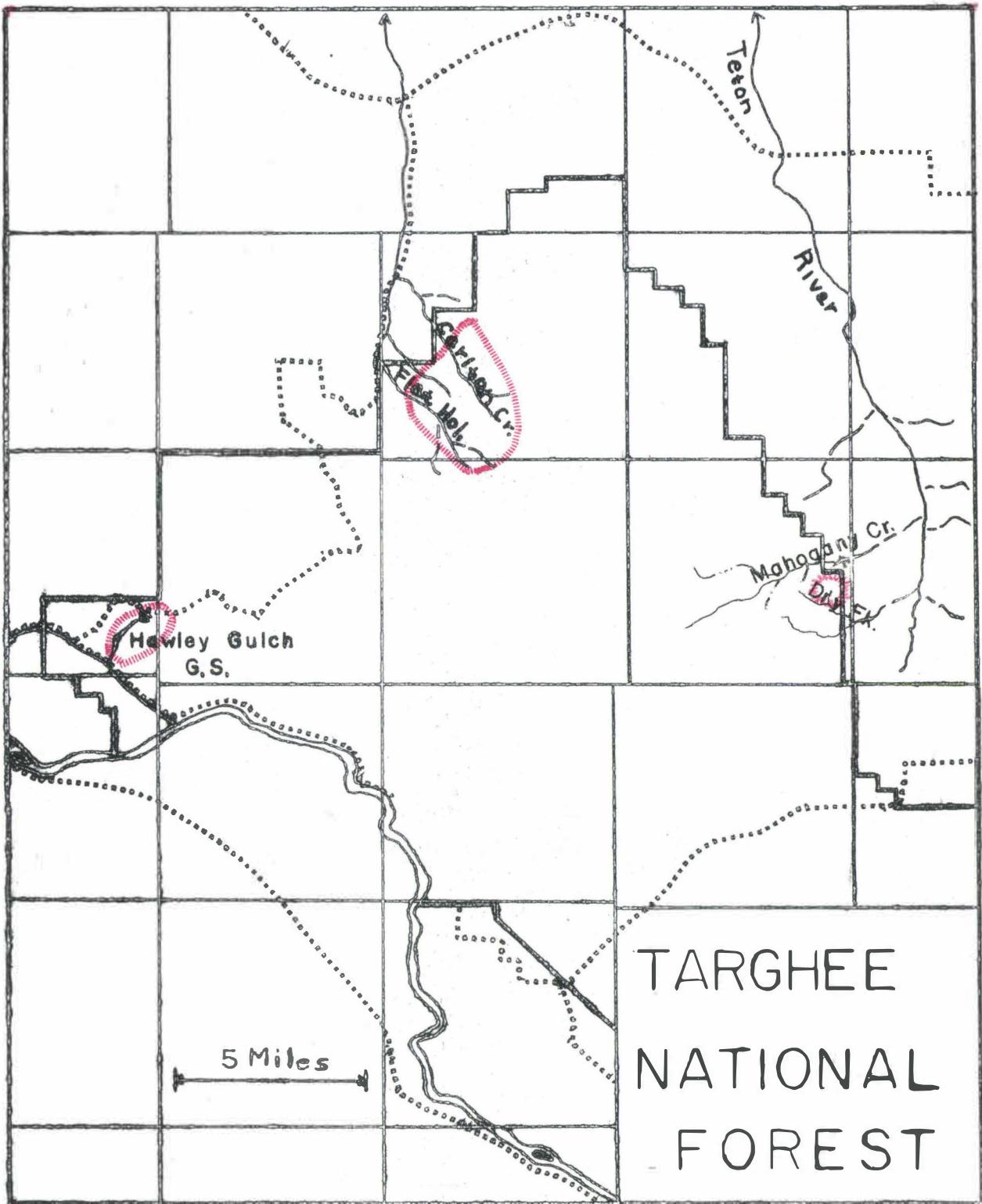
INFESTATION BOUNDARIES

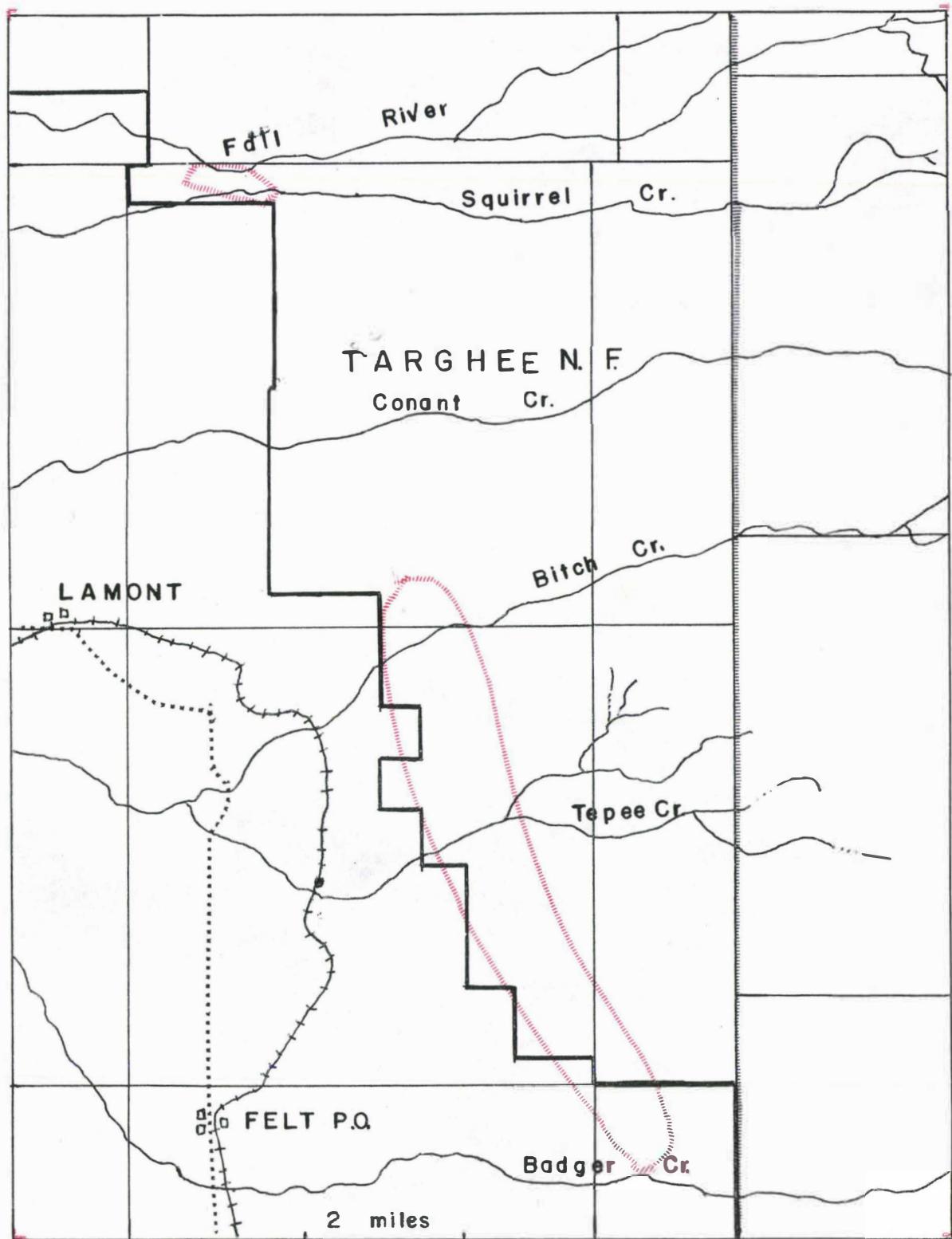


ROADS

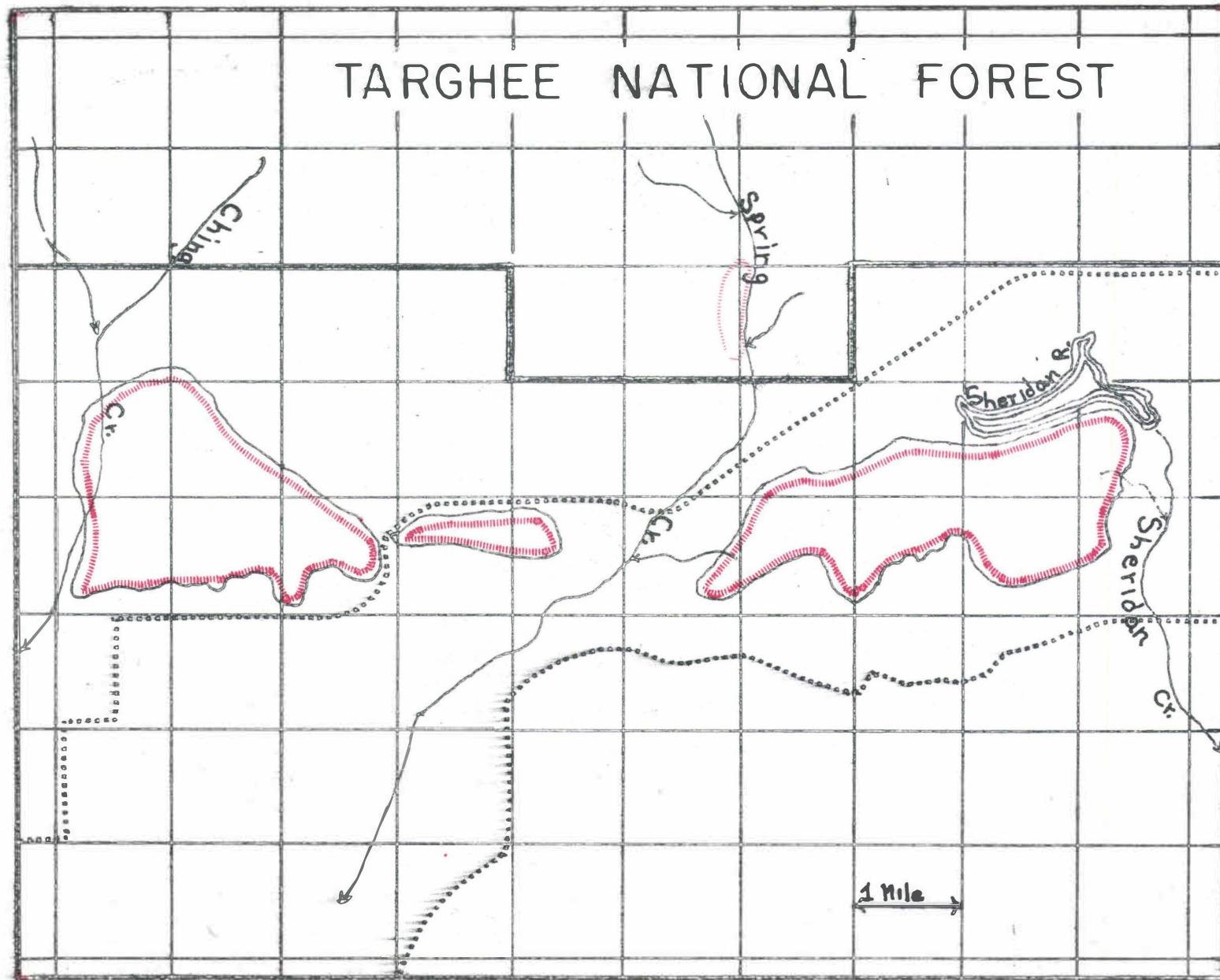
NOTE

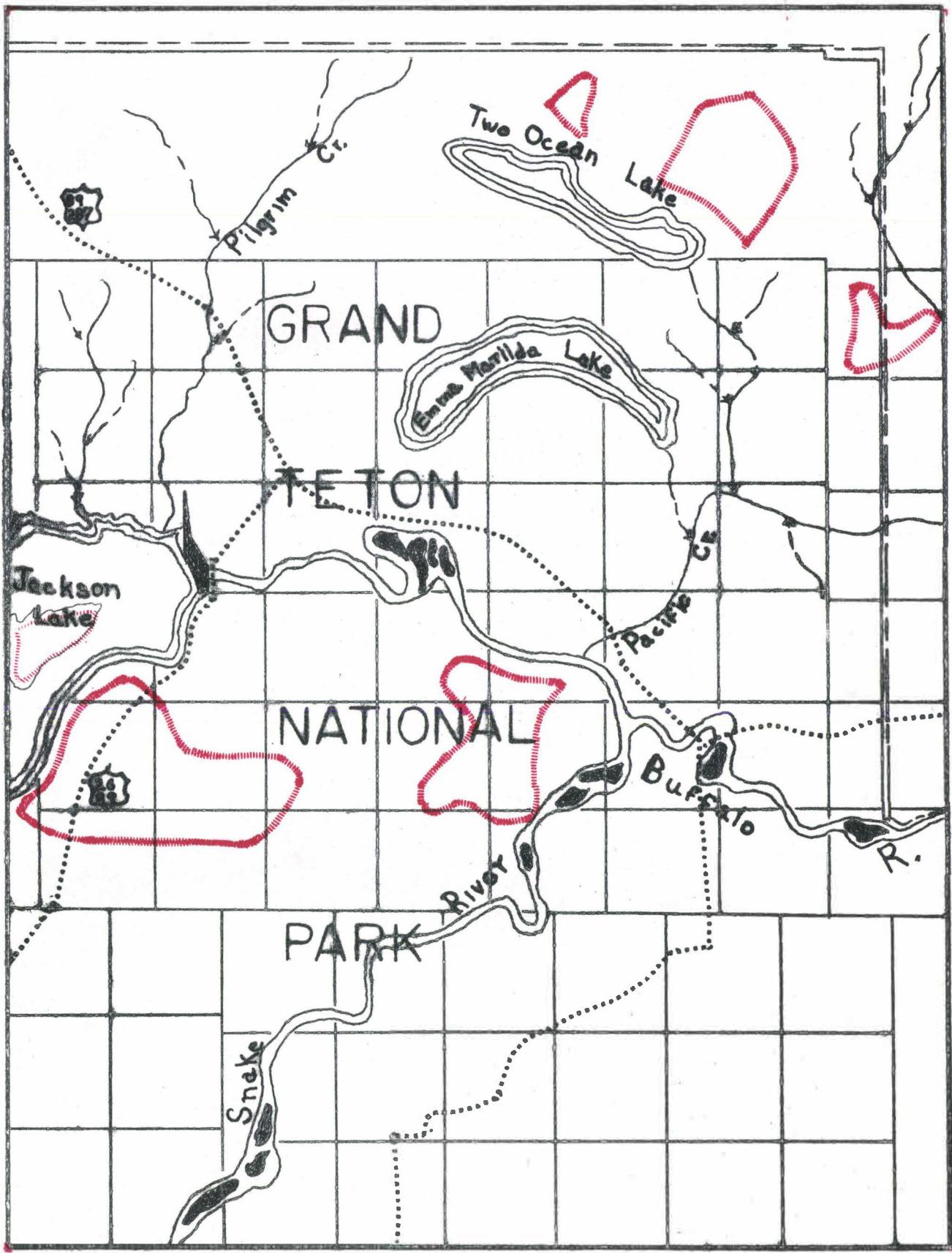
INDIVIDUAL MAPS VARY AS TO SCALE

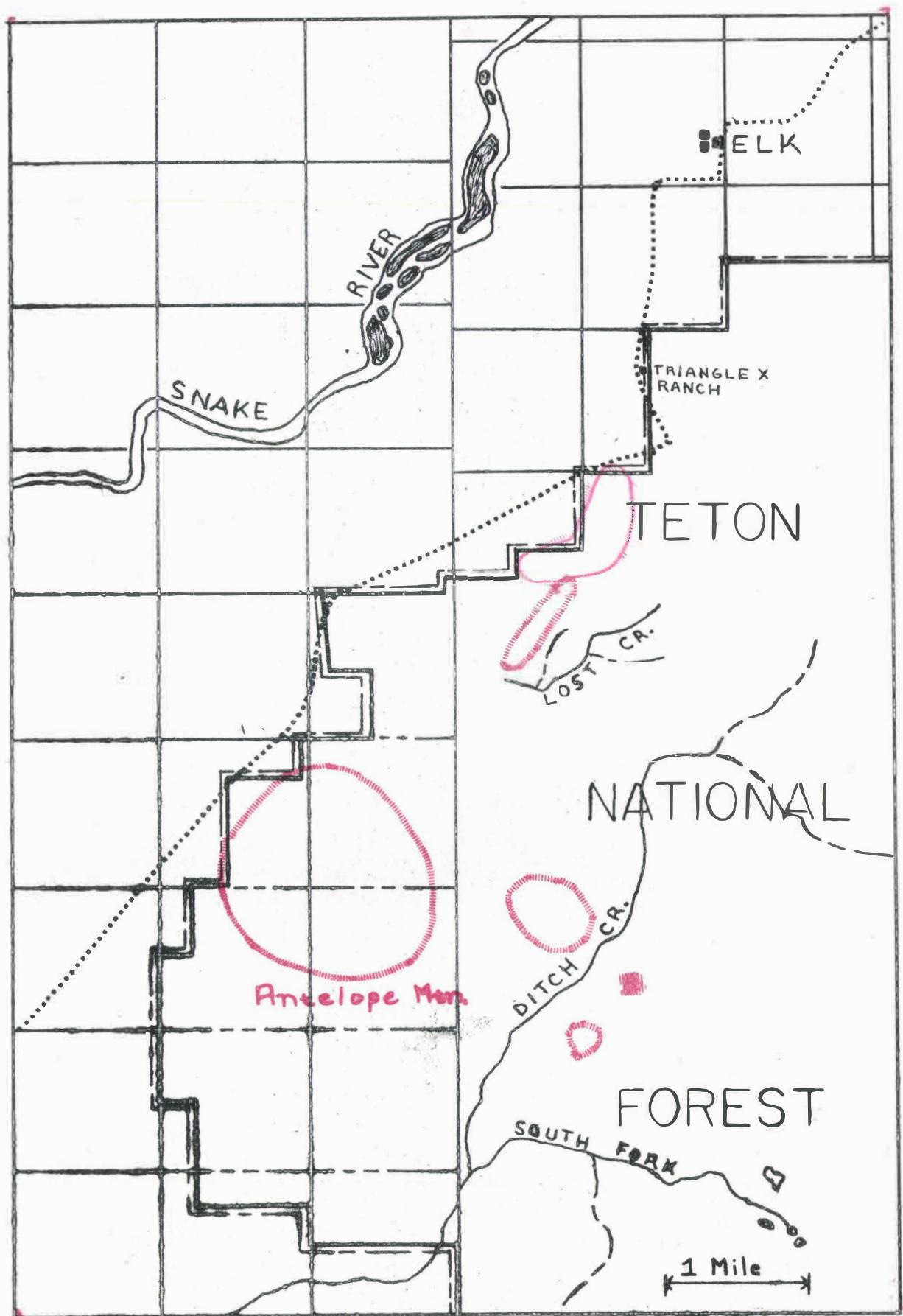


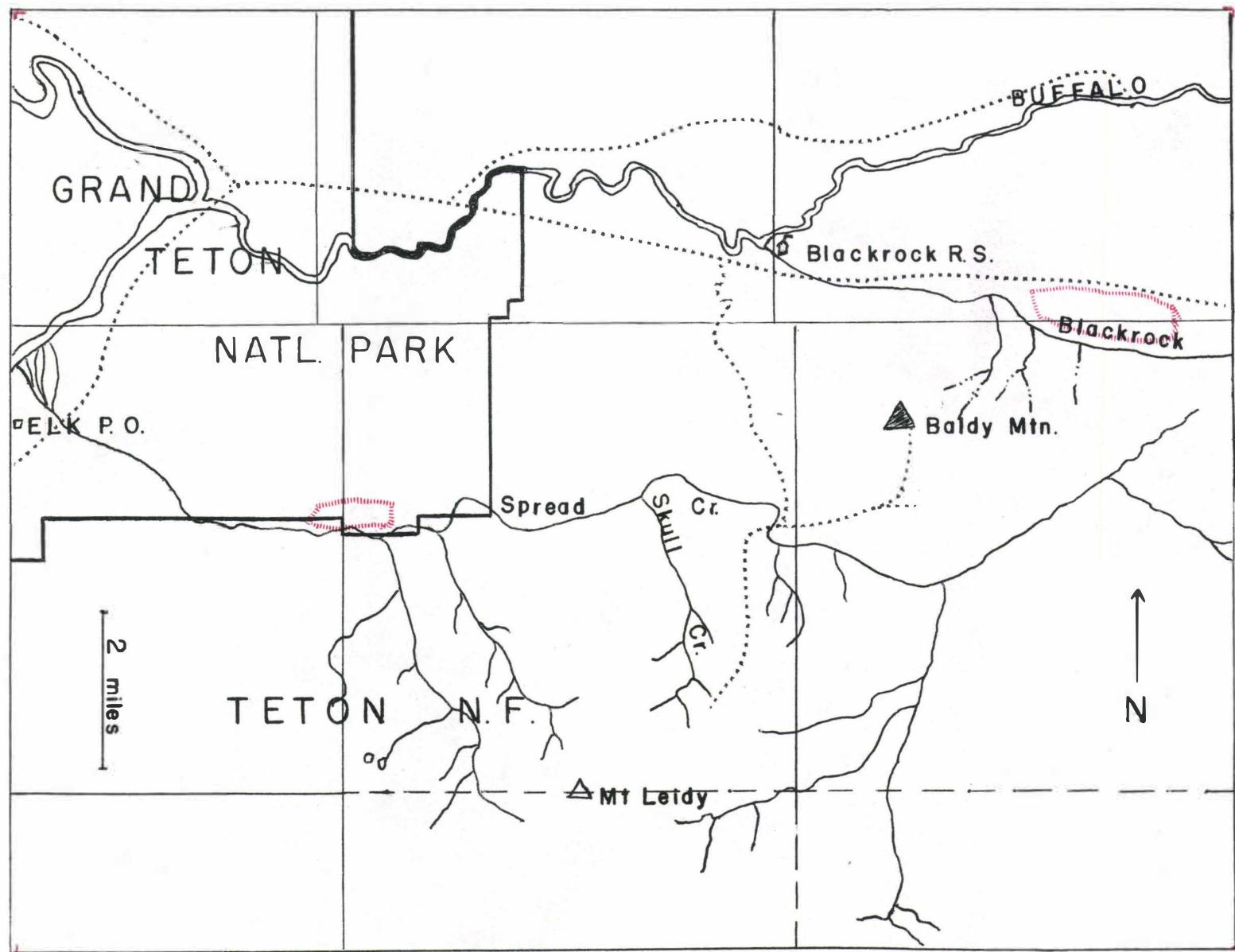


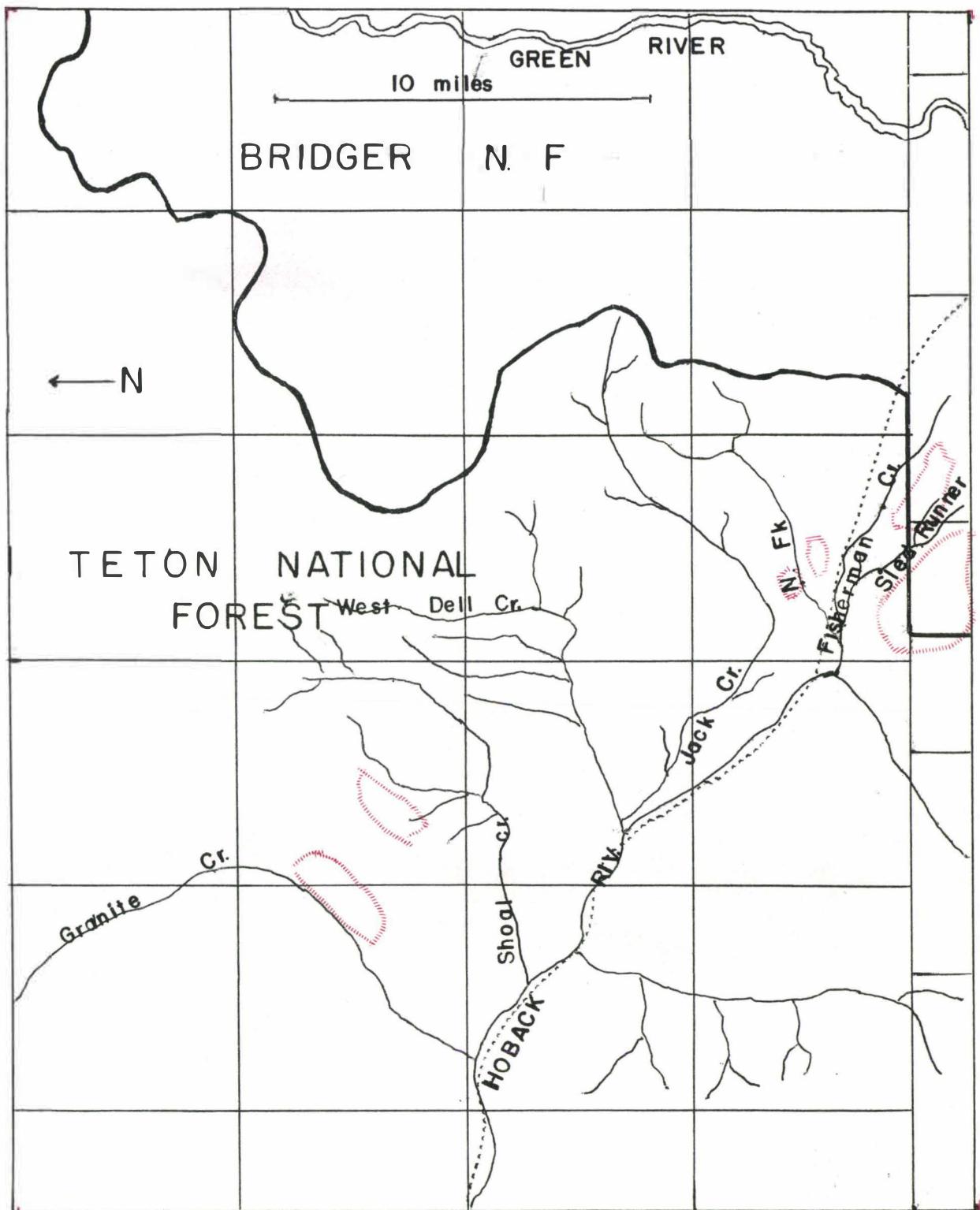
TARGHEE NATIONAL FOREST

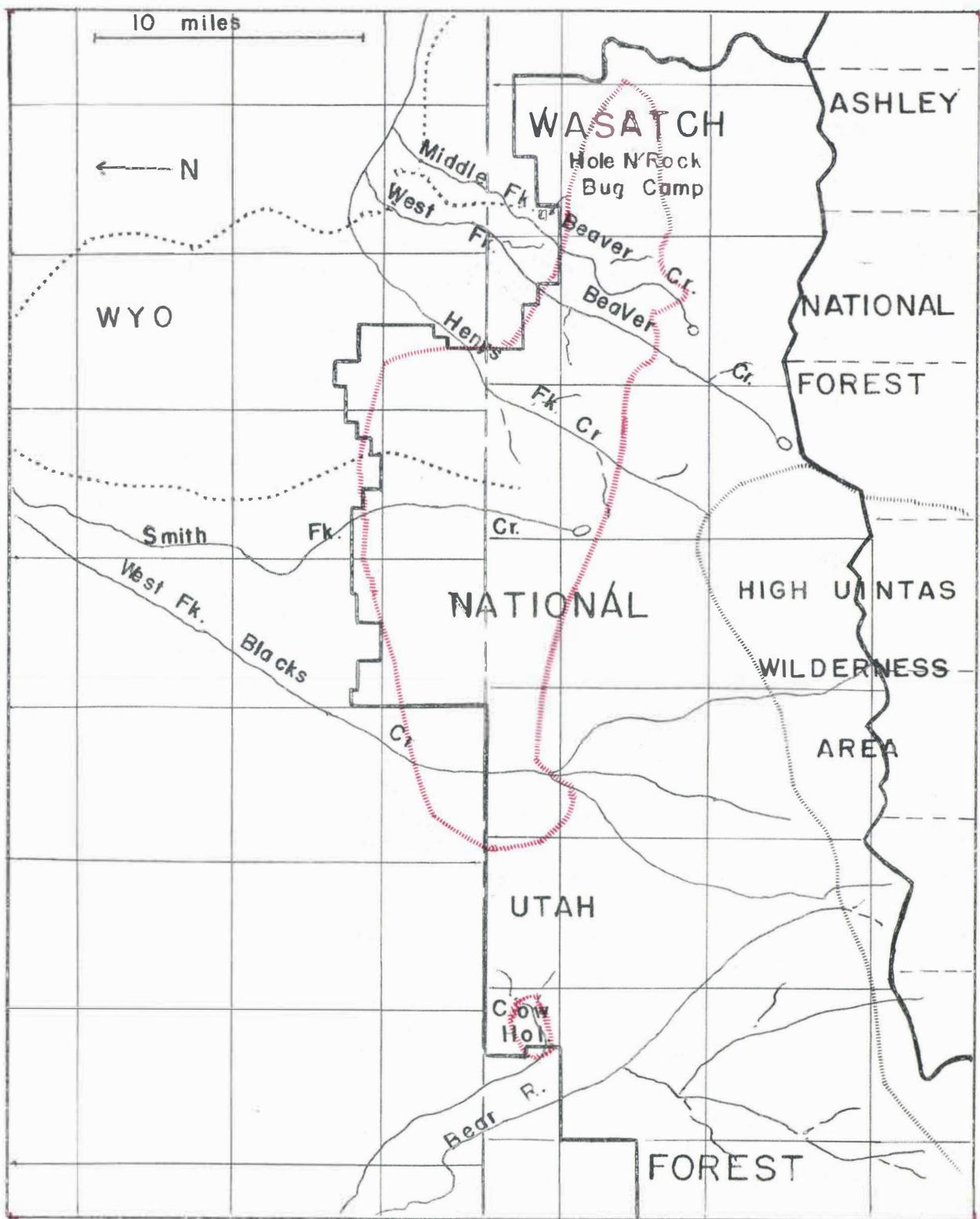


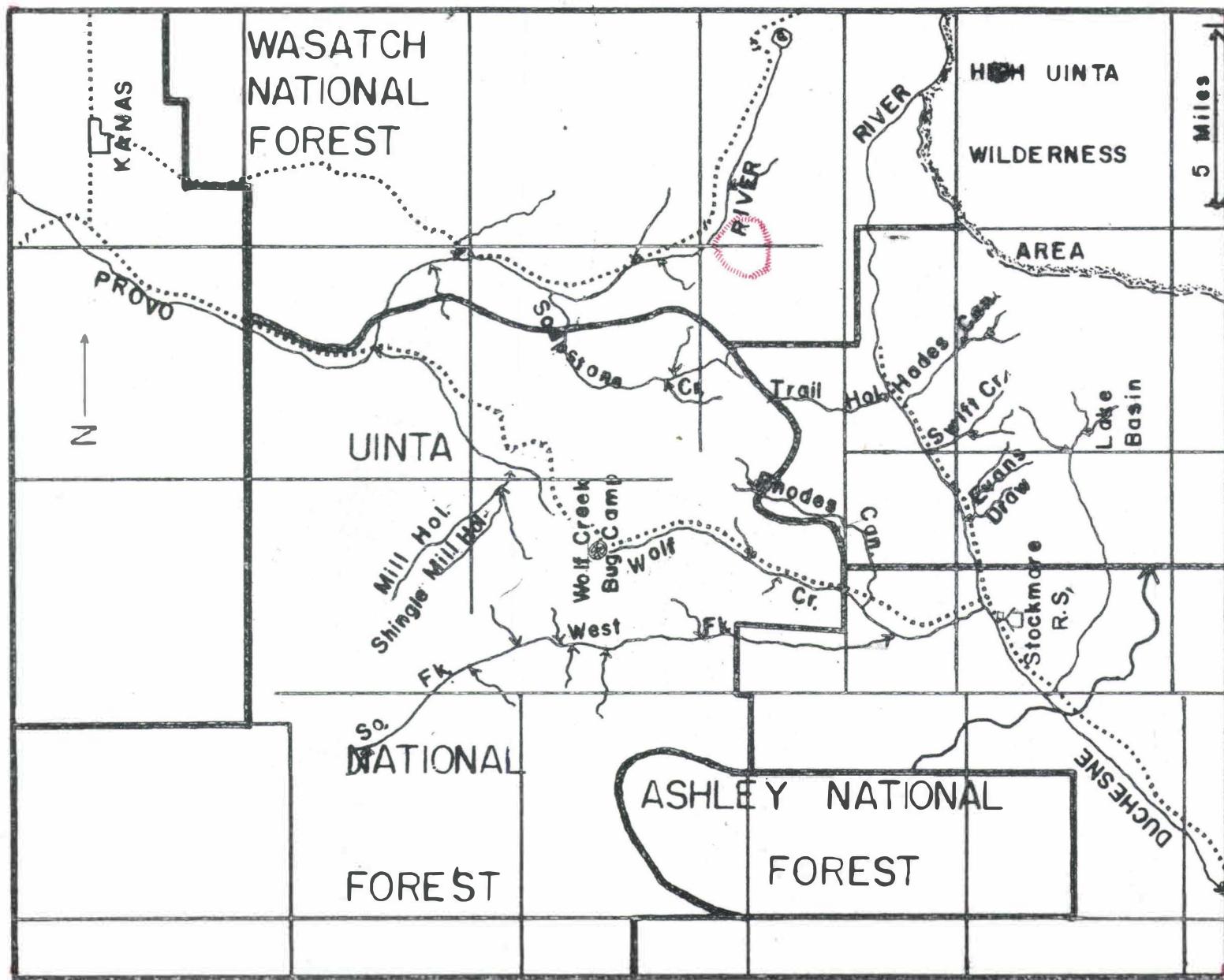


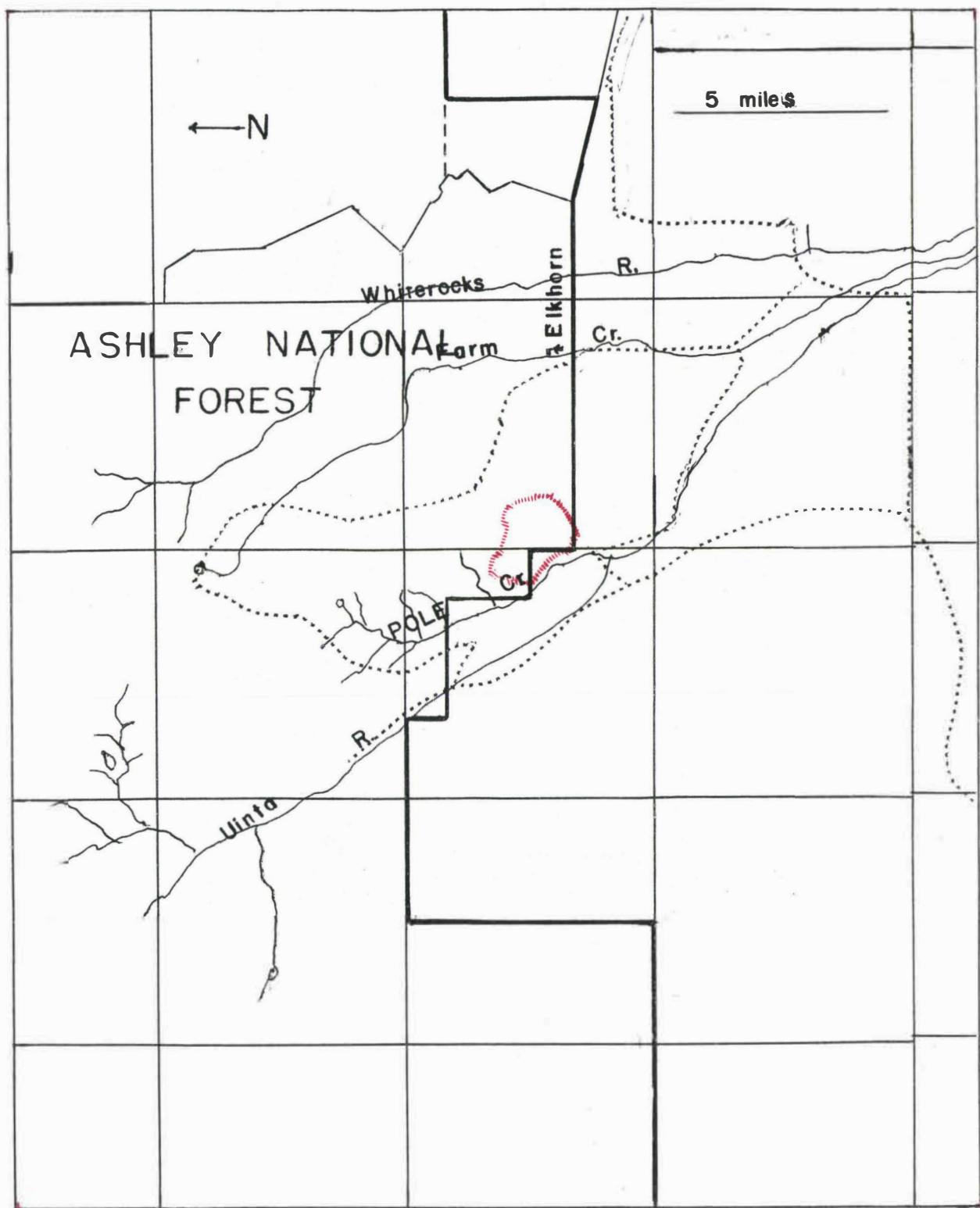


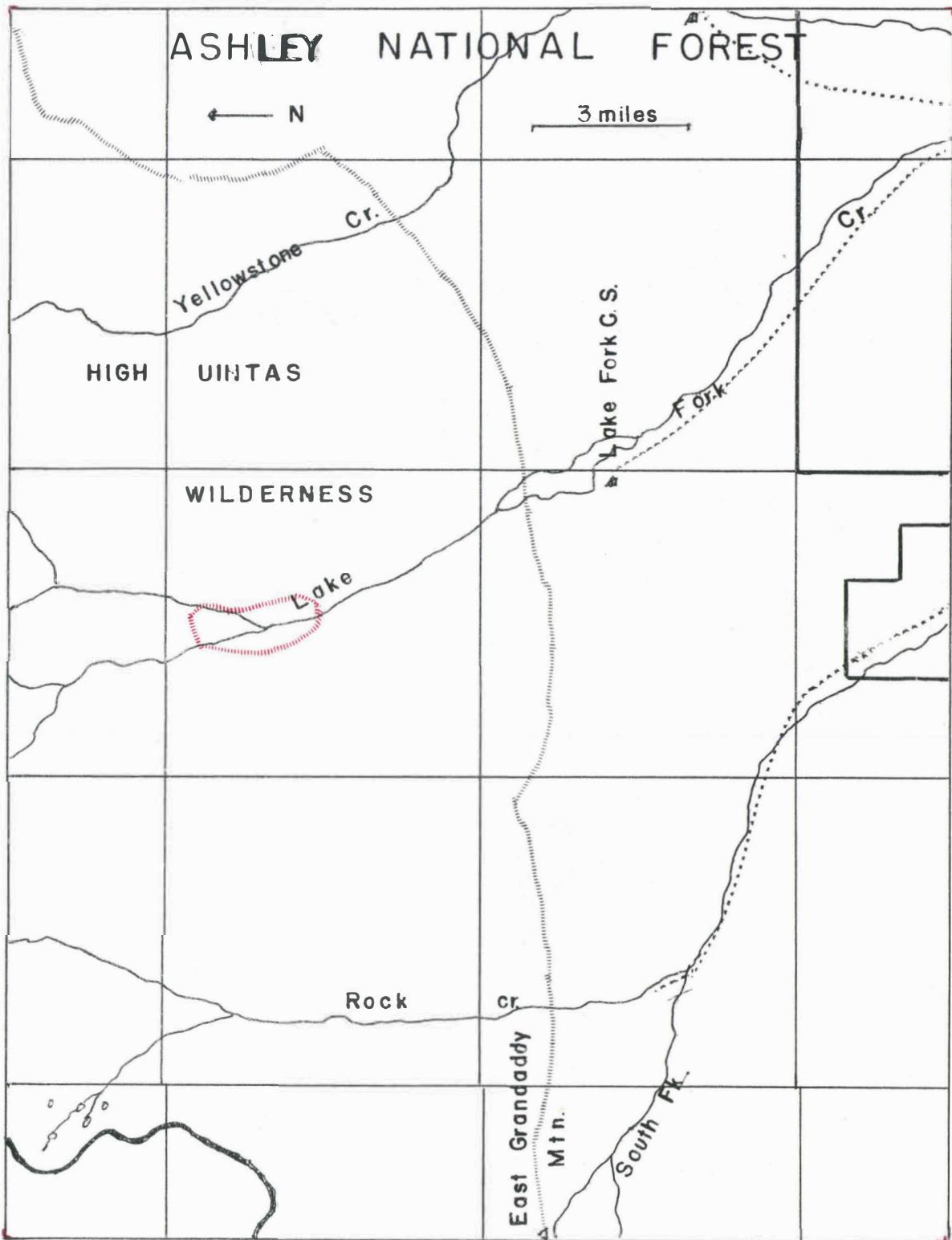






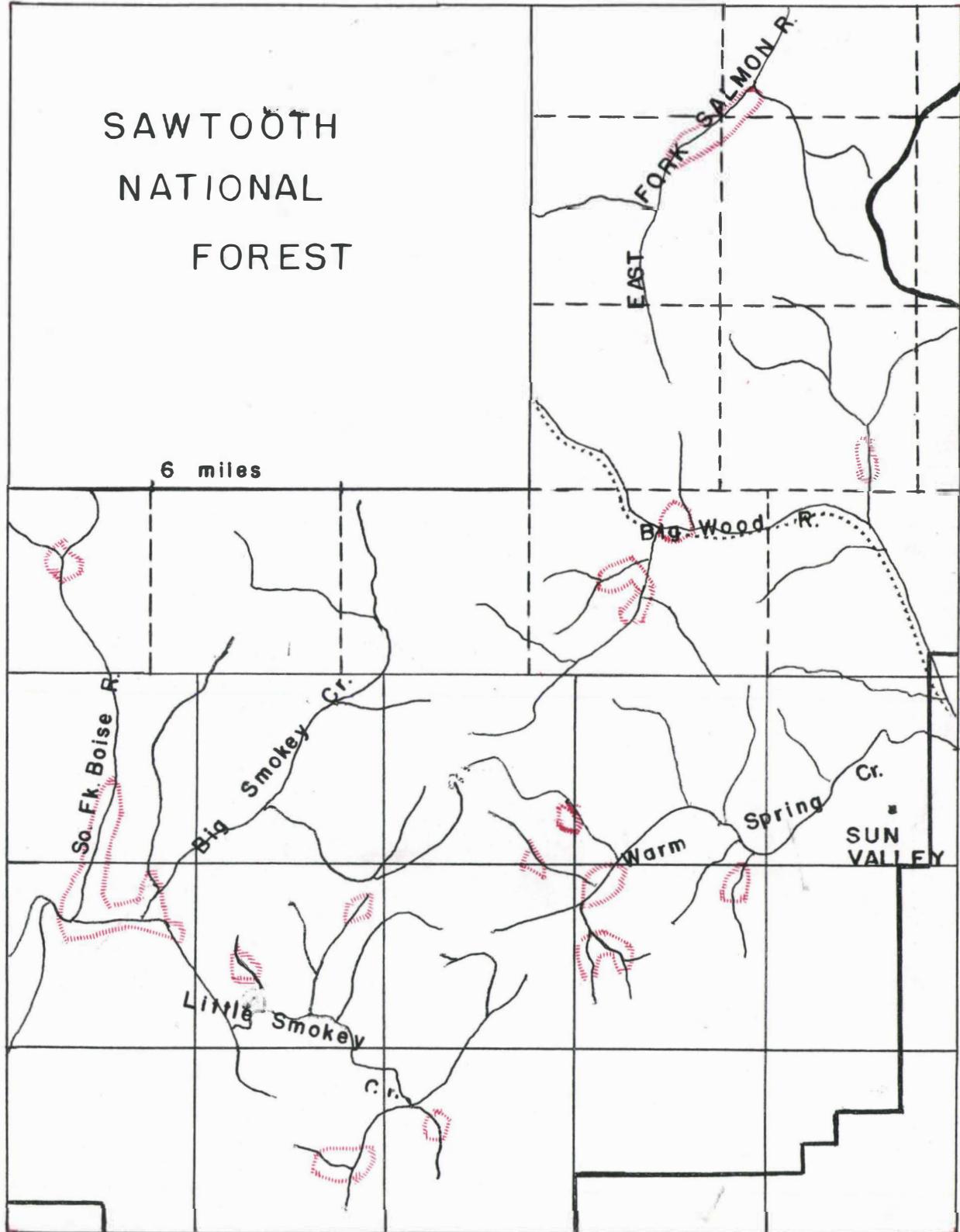


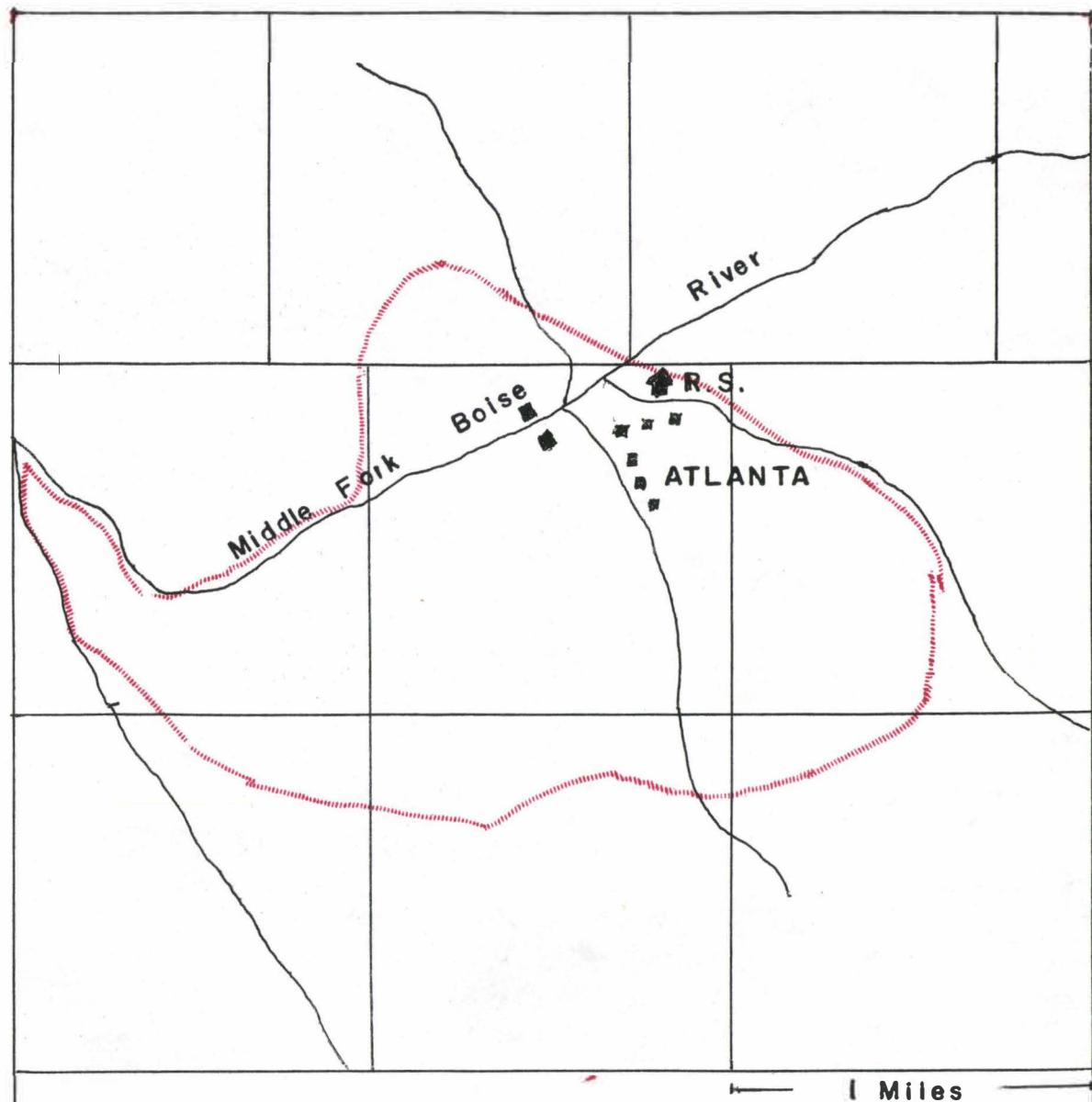




SAWTOOTH NATIONAL FOREST

6 miles





BOISE
NATIONAL FOREST

